GEOLOGY OF THE DRY CANYON AREA IN THE EASTERN SECTION OF THE VENTURA BASIN, CALIFORNIA.

by

Joseph Stewart Martin

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Abstract

The Dry Canyon area is located in the eastern section of the Ventura Basin in northwestern Los Angeles County, California.

The following problems confronted the writer in this area: (1) the relationships between the marine and the non-marine sediments of the basin (2) the general stratigraphy (3) the faulting along the base of the Sierra Pelona mountain range which borders the basin on the north.

Three Tertiary sedimentary formations are exposed in the area. The Saugus and the Mint Canyon are non-marine formations. The third formation is the Modelo which is the only marine strata exposed north of the Santa Clara River in this section of the Ventura Basin.

There is an unconformity between each pair of formations. The unconformity between the Modelo and the Mint Canyon is the most distinct.

The Modelo is much thicker in this area than the Modelo section further east in the basin, but the Mint Canyon is about half as thick as it is to the east.

There is moderate folding in the area. A major anticline, in which the stratigraphic sequence is exposed, plunges to the west from Haskell Canyon. The general of the axes of the folds in the sediments is in an east-west direction.

There is a rift zone along the basin edge of the Sierra Pelona Ridge which borders the area to the north. The faults in this zone range in dip from 20 to almost 90 degrees. The fault is normal in character and consists of a series of faults and is not a single fault.

The fault has cut off several thousand feet of the Mint Canyon formation and older sedimentary formations.

1. Introduction

Nature and scope

This field study was made in partial fulfillment of the requirements for the degree of Master of Science at the California Institute of Technology.

In order to obtain a clearer concept of the stratigraphy of the eastern section of the Ventura Basin, to determine the relationships between the marine sediments and the continental sediments, and to work out the problem of the faulting along the basin edge of the Sierra Pelona Ridge, the writer spent some 25 field days between October 1946 and May 1947 in reconnaissance and detailed mapping in an area between Haskell Canyon and San Francisquito Canyon in Los Angeles County, California. This area contains a good section of the Mint Canyon formation and the overlying marine and continental sedimentary formations as well as the basement complex of the Sierra Pelona Ridge.

The topographic map prepared by the United States Geological Survey was enlarged to the scale of 1 inch to 1000 feet and was used as a base map. Aerial photographs prepared by the Fairchild Aerial Surveys Inc. of Los Angeles, California were used for field mapping and were used in conjunction with the topographic maps.

The Modelo section was measured with a steel tape. The Mint Canyon section was obtained partially by the compass and pace method and the other part was taken off of the topographic map.

Acknowledgments

This investigation was made under the direction of Dr. Richard H. Jahns to whom the writer is indebted for his advice on the writing of the manuscript, for bringing up structural and stratigraphic problems which occurred in conjunction with the field work, and for showing interest throughout the various phases of the work.

Appreciation is given to Mr. E.C. Buffington who aided the writer in measuring a section of the Modelo formation.

Appreciation is also given to Dr. J.H. Maxson, Dr. J.E. Durham, Mr. J. Lance, Mr. R.C. White, Mr. R.J. MacNeill, Mr. W. Dort, Mr. J.T. Murphy, and Mr. C.D. Edwards who aided the writer in the field work and discussed the various problems which arose in the course of the work with the writer.

2. General description of the area

Location and size

The Dry Canyon area is in the eastern section of the Ventura Basin which is located in northwestern Los Angeles County, California. (see Fig.1) The area lies between latitudes 34 deg. 26 min. north and 34 deg. 31 min. north and longitudes 118 deg. 30 min. west and 118 deg. 33 min. west. The area includes parts of Saugus and Red Mountain quadrangles of Los Angeles County. The mapped area is about thirty-five miles northwest of Pasadena and two miles north of Saugus, a small town on the Southern Pacific Railroad Line between Los Angeles and Mojave.

The size of the area is about 15 square miles.

Relief and elevation

The elevation of the highest points in the area is 2200 feet above sea level. These points are on the Sierra Pelona Ridge. The elevation of the crest of the Haskell Canyon anticline is 2031 feet above sea level. The lowest elevation is about 1200 feet above sea level on the edge of the Santa Clara Valley. The terrain is rugged in certain parts of the area as in the Haskell Canyon anticline where the relief is 831 feet from the top of the anticline to the floor of the canyon below.

DRY CANYON AREA

INDEX MAP

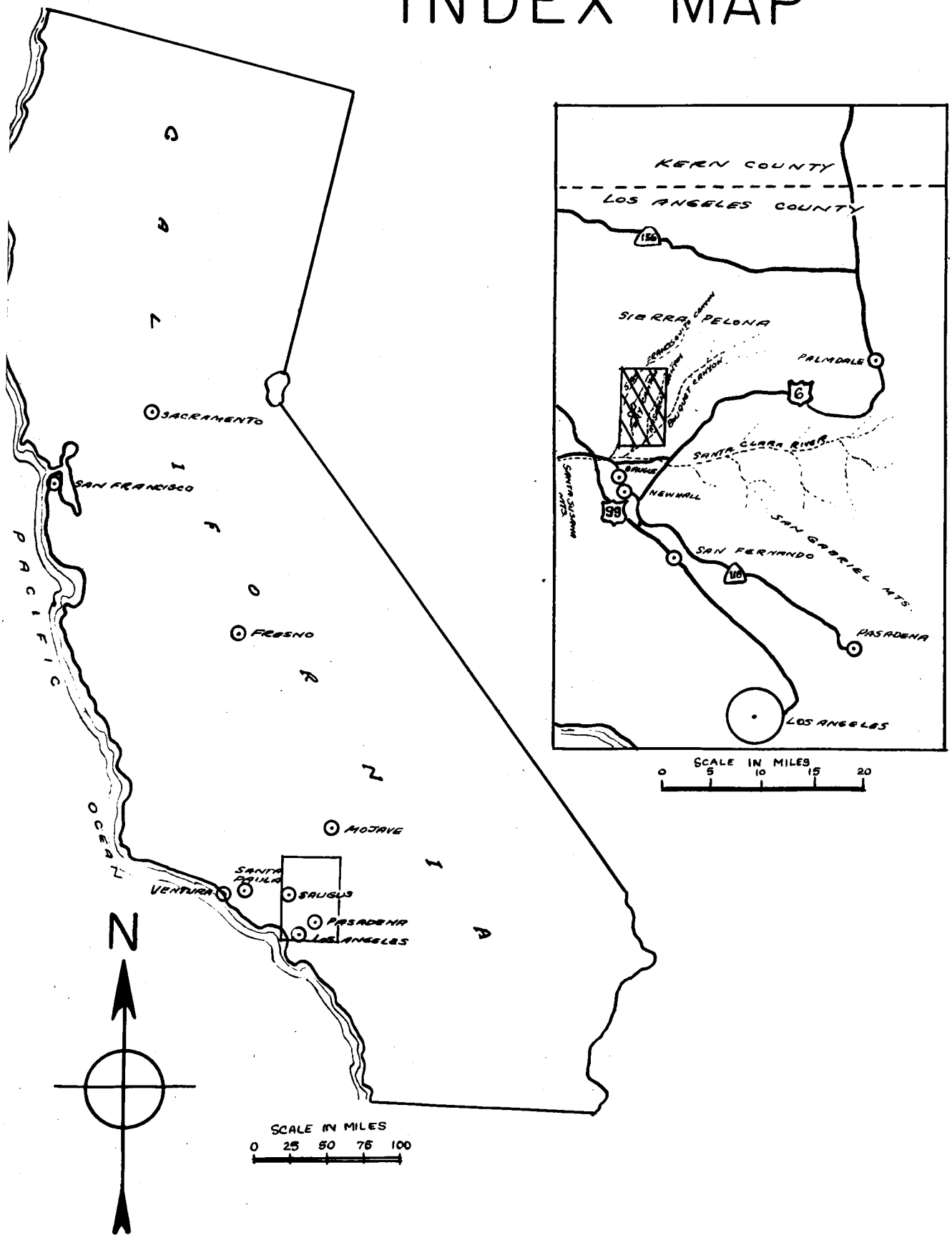


FIG. 1

In contrast,other sections have gentle slopes and rounded hills. The lower reaches of the canyons near the Santa Clara Valley are very broad and flat.

Drainage

The principal water course of the Ventura Basin is the Santa Clara River,which flows westward about two miles south of the southern boundary of the mapped area. In the vicinity of Saugus,Bouquet Canyon joins this river from the northeast. The main drainage of the area itself is from San Francisquito Canyon on the west which joins the Santa Clara River,Dry Canyon in the central portion, and from Haskell Canyon on the east. Both Dry and Haskell Canyons drain into Bouquet Canyon. The streams flow intermittently during the winter rainy season and are dry during the remainder of the year. The drainage in the area mapped is from the high Sierra Pelonas southward to the central low of the Ventura Basin.

Vegetation

Two principal types of vegetation occur in the area. These roughly are related to the type of soil present and to the underlying rock formations. On the sandstones and the conglomerates heavy chaparral brush,manzanita, and the century plant are the dominant types of vegetation.

while on the shales and the siltstones the dominant types are grasses and sage brush. Live oaks and sycamores are scattered in the canyon bottoms and on the north slopes of the canyons. The most common types of vegetation on the schists of the Sierra Pelona Ridge are chaparral and the century plant.

Rock exposures and general topography

The exposures in the area are generally very good except in the areas covered by terrace materials, the canyon bottoms which are covered by recent alluvium, and the areas covered by very heavy and thick brush. Badlands topography has been developed in the unconsolidated continental sediments. In the more consolidated sediments many canyons are boxlike, with almost vertical rock wall exposures.

The topography in general reflects the types of rocks present, as it changes from the rugged crystalline peaks of the Sierra Pelona Ridge (see Fig.2) to boxlike canyons in the consolidated continental sediments, (see Fig.3) to rolling hills in the marine sandstone and shale series, (see Fig.4) and finally to badlands topography in the unconsolidated continental beds. (see Fig.5)

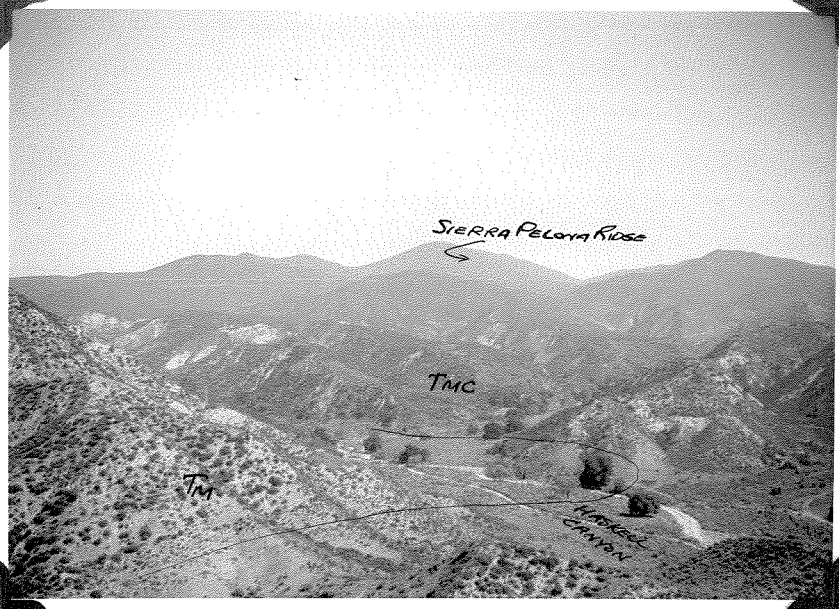


Fig.2
Topography in the Mint Canyon and the Basement Complex.

Fig.3
Topography in the Mint Canyon formation.

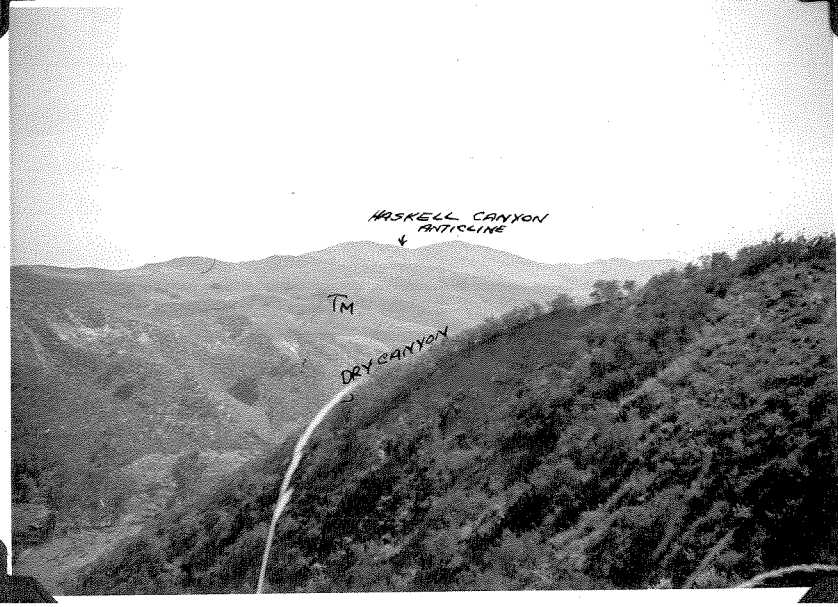


Fig.4
Topography in the Modelo formation.

BLOCK DIAGRAM DRY CANYON AREA

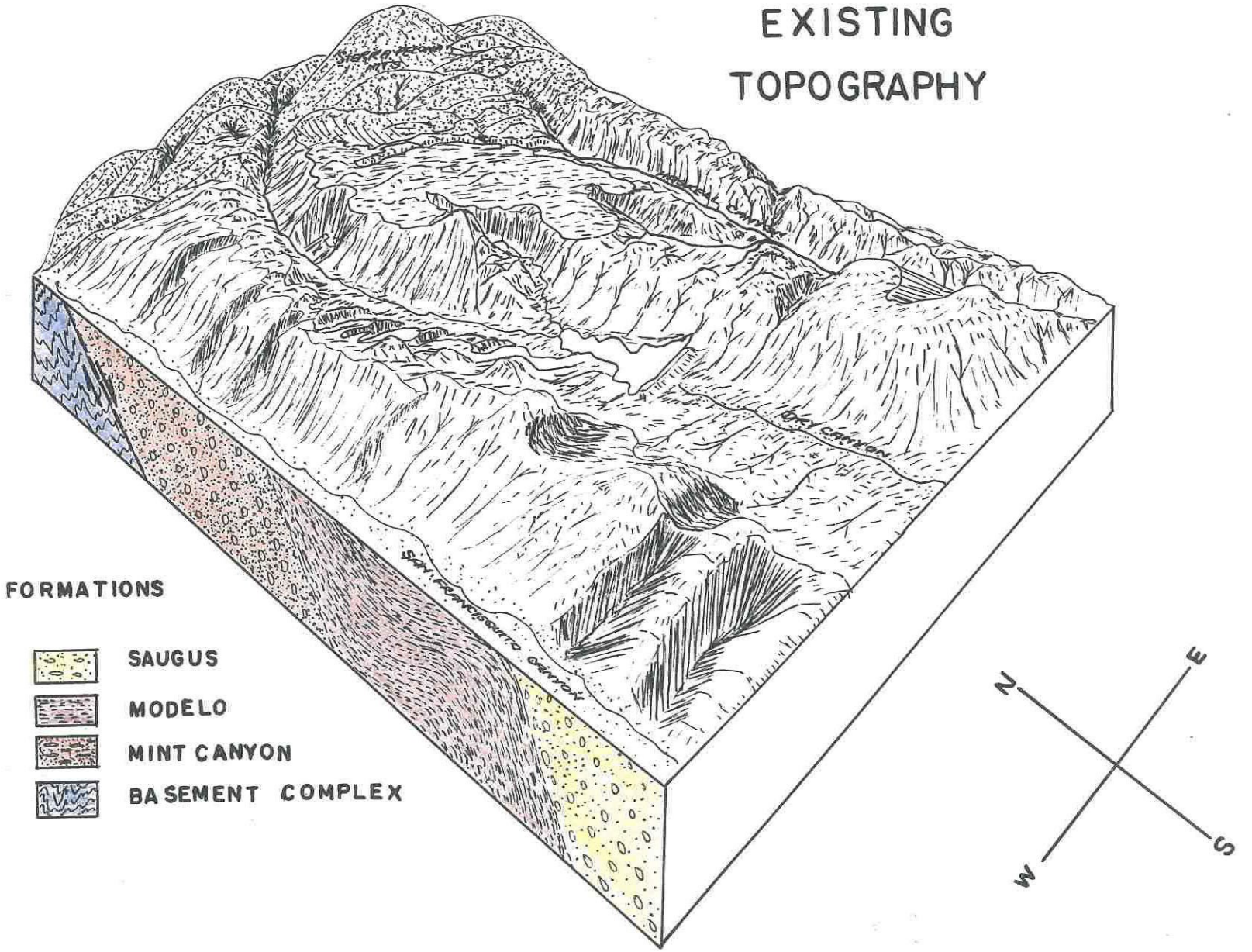


FIG. 5

Culture

There are several good roads leading to the area from the metropolitan district of Los Angeles. U.S. Highway 6 extends from U.S. Highway 99 north of San Fernando through Fremont Pass to Newhall and then to Saugus. From Saugus the mapped area can be reached over two paved roads, the San Francisquito Canyon Road and the Bouquet Canyon Road. Unimproved dirt roads reach to the heads of Haskell and Dry Canyons. Except for these few main roads the area is quite inaccessible by automobile.

The area is primarily an agricultural area;the floors of Bouquet Canyon,Dry Canyon,Haskell Canyon and San Francisquito Canyon are under cultivation. Much of the untillable land is used for the grazing of cattle,horses, and goats. A chicken farm is located in San Francisquito Canyon. Two large hog ranches are situated in lower Haskell Canyon. The Bureau of Water and Power of the City of Los Angeles has a small reservoir in Dry Canyon which is used in conjunction with the Los Angeles Aqueduct which carries water from Owens Valley to Los Angeles. This aqueduct traverses the center of the area in a north-south direction. Several high power transmission lines of the Southern California Edison Company cross the area.

About half of the area is within the Angeles National Forest and is relatively uninhabited except for a few homesteaders in upper Haskell Canyon.

3. Stratigraphy

General statement

The eastern Ventura Basin consists of a Pre-Cretaceous basement complex over part of which a thick section of predominately non-marine Tertiary sediments has been deposited.(see Fig.6) The sediments decrease in age toward the center of the basin. The younger Tertiary sediments are much more unconsolidated than the older sediments.

Crystalline basement complex

The crystalline rocks are exposed in the northern section of the Dry Canyon area along the base of the Sierra Pelona Ridge. The predominating rock is a fine grained bluish gray schist termed the Pelona schist in which many of the old sedimentary structures are still present. These structures include bedding and possible small folds. (see Fig.7) No detailed work was done on these rocks. No definite age can be given them but they are in general considered to be Pre-Cretaceous.

Mint Canyon formation

The Mint Canyon formation in this area is 2300 feet thick,(see Fig.6) and thus is considerably thinner than the 4044 feet[1]exposed in the more easterly section

1. Jahns,R.H.,Stratigraphy of the easternmost Ventura Basin, California,with a description of a new lower Miocene mammalian fauna from the Tick Canyon formation:Carnegie Inst. Washington Pub. No. 514,p.154,162,1940.

AGE	UNIT
PLEISTOCENE & RECENT	ALLUVIUM AND TERRACE GRAVELS
PLIOCENE	SAUGUS FORMATION – NON MARINE
MIOCENE	MODELO FORMATION - MARINE
	MINT CANYON FORMATION – NON MARINE
PRE-CRETACEOUS	CRYSTALLINE BASEMENT COMPLEX

STRATIGRAPHY DIAGRAM

FIG. 6

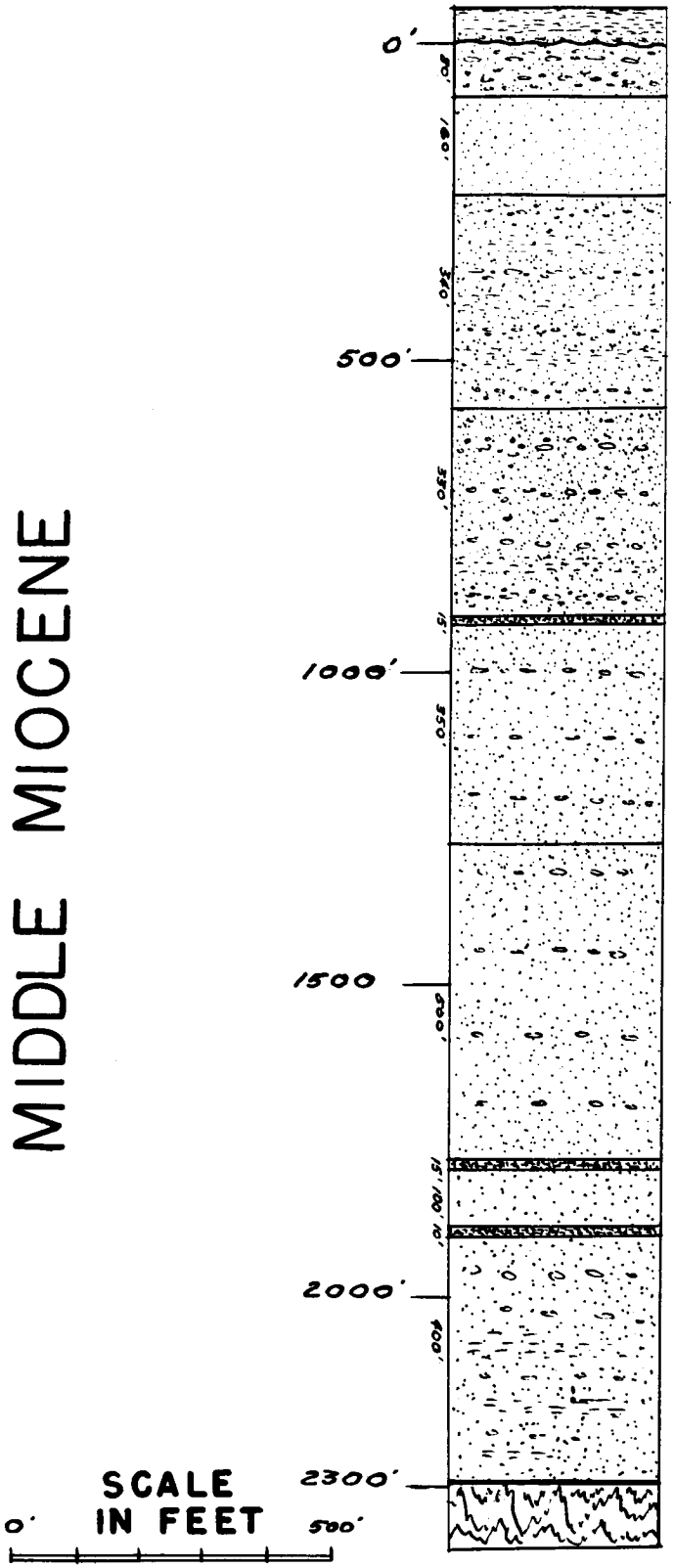
Fig.7

The basement complex.

COLUMNAR SECTION & LITHOLOGY

MINT CANYON FORMATION

MIDDLE MIOCENE



MODELO SS AND SH

UNCONFORMITY

GRAY COBBLE CG, WELL CEMENTED RED SS BEDS, 1' THICK

BLUFF, COARSE, MASSIVE SS.

ALTERNATING GRAY COARSE SS INTERBEDD WITH BEDS OF COBBLE CG. AND RED SILTSTONE BEDS 100' THICK

COARSE YELLOW BUFF SS, INTERBEDDED WITH PEBBLE TO COBBLE CG, SCATTERED RED SILTSTONE BEDS.

GRAY-WHITE TUFF BED, NOT WELL BEDDED

MASSIVE, BUFF YELLOW SS, INTERBEDDED WITH BEDS AND LENSES OF PEBBLE TO COBBLE CG

BUFF SS, WITH PEBBLE TO COBBLE CG. BEDS, SCATTERED COARSE YELLOW SS BEDS

GRAY-WHITE TUFF BED, NOT WELL BEDDED.

BUFF SS, SOFT, FRIABLE

GRAY-WHITE TUFF BED, NOT WELL BEDDED

MASSIVE, BUFF SS, INTERBEDDED WITH COBBLE TO PEBBLE CG BEDS AND GRAY TO RED SILTSTONE BEDS

FAULT

BASEMENT COMPLEX, PELONA SCHIST

FIG. 8

of the Ventura Basin. The areal extent of this formation is about two-thirds that of the overlying Modelo formation within the Dry Canyon area.

The section of the Mint Canyon formation varies considerably in lithology. Near the base of the section exposed in the Dry Canyon area the beds are predominately buff colored conglomeritic sandstones with a few scattered white tuff beds. (see Figs.8,9,&10) Characteristic lacustrine deposits occur higher up in the section. These beds are gray to red silts,white tuff beds,and buff sandstones and conglomerates. The tuff beds occur throughout the section,thus active vulcanism took place in the Mojave Desert region throughout the period of deposition of the Mint Canyon.

In the more easterly section of the Ventura Basin the Mint Canyon lies on the Tick Canyon and the Vasquez series. In the Dry Canyon area there is no evidence upon what the Mint Canyon formation lies. It may lie on the Tick Canyon and the Vasquez series or it may lie directly on the basement complex.

The Mint Canyon formation is here considered to be middle Miocene in age.

Modelo formation

Overlying the Mint Canyon formation unconformably is a series of marine sandstones and shales called the Modelo formation. The section in this area is 666 feet thick. (see Fig.11) This is much thicker than the

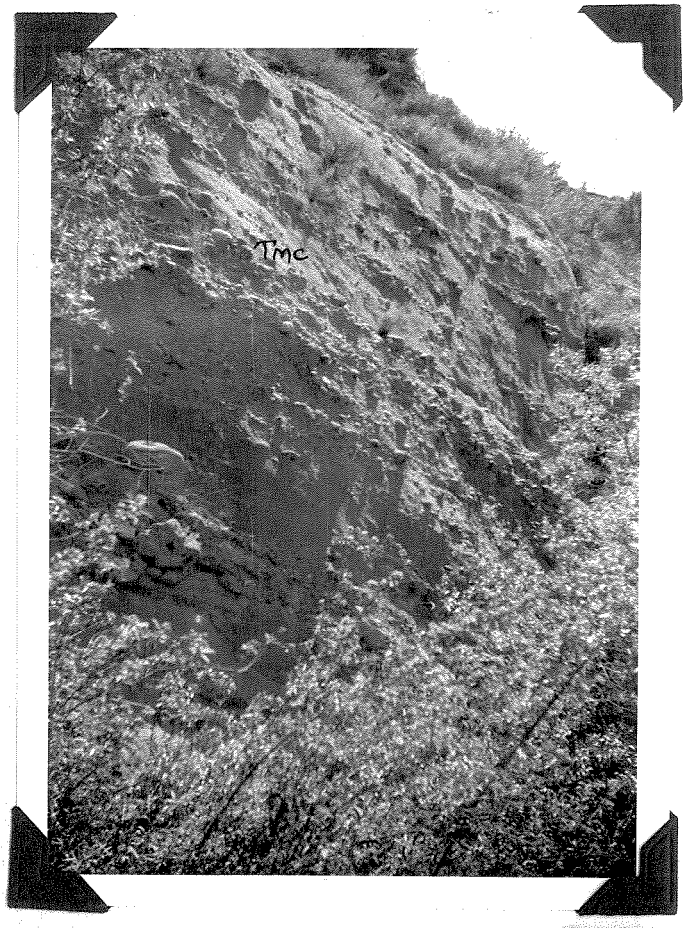


Fig.9
Mint Canyon
conglomerate

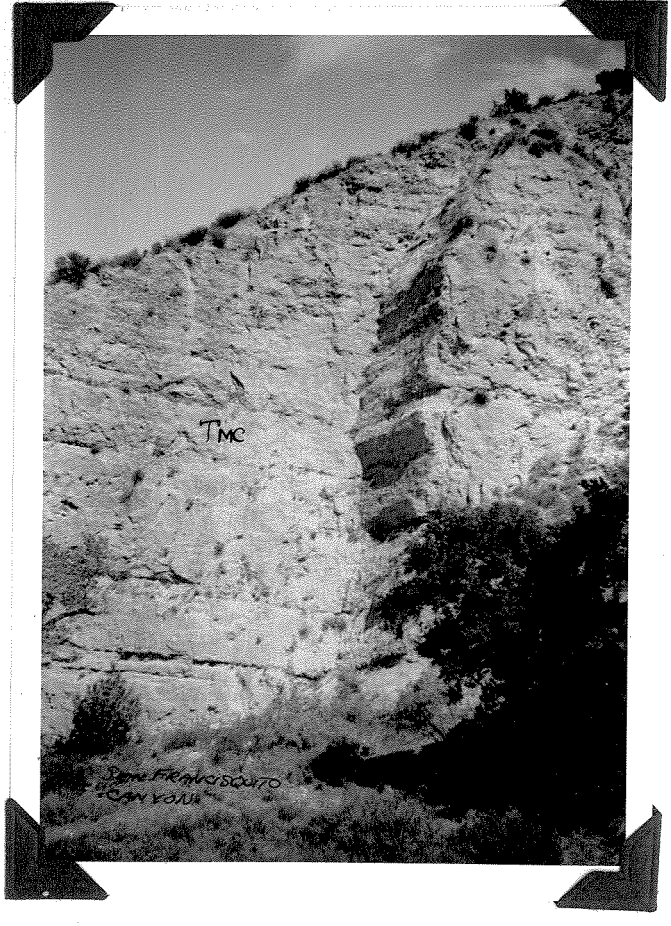
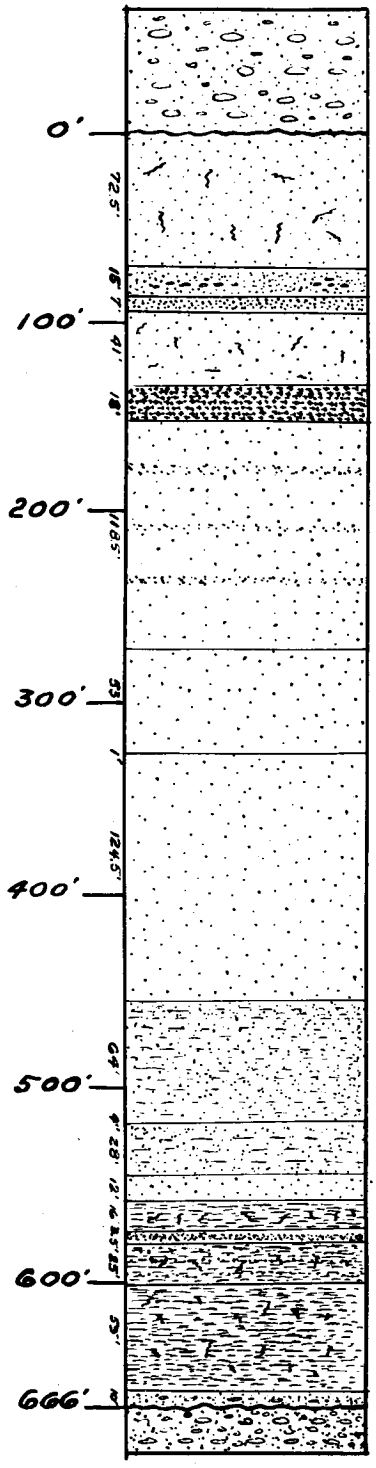


Fig.10
Mint Canyon
conglomerates and
sandstones

COLUMNAR SECTION & LITHOLOGY

MODELO FORMATION
UPPER MIOCENE



SCALE IN FEET

100' 50' 0' 100'

FIG. 11

487 feet measured in a more eastern part of the Ventura Basin by R.H. Jahns.[2]The thicker section in the Dry Canyon area is due to a difference in the conditions of sedimentation. The more easterly part of the Ventura Basin was further from the center of marine deposition within the basin than the Dry Canyon area.

The Modelo section varies in lithology from the base of the section to the top. The lower section is predominately fine brown shales interbedded with sandstones and siltstones. (see Figs.12&13) This series of sediments was deposited under brackish water conditions. The region was low in relief and erosion was not rapid so the fine clastic sediments could be deposited. Even swampy conditions prevailed during this period as is shown by the presence of a four-inch bed of peat admixed with lumps of charcoal. The conditions must have been very marshy and the waters very quiet,much like the paralic conditions in the formation of coal. As the period progressed, the conditions changed rapidly,uplift occurred,and the relief was raised causing a subsequent increase in erosion. The streams began to carry heavier and coarser loads down to the sea which resulted in the deposition of pebbly sandstones and coarse sandstones that occur near the top of the

2. Jahns,R.H.,Stratigraphy of the easternmost Ventura Basin, California,with a description of a new lower Miocene mammalian fauna from the Tick Canyon formation:Carnegie Inst. Washington Pub. No. 514,p.155,1940.

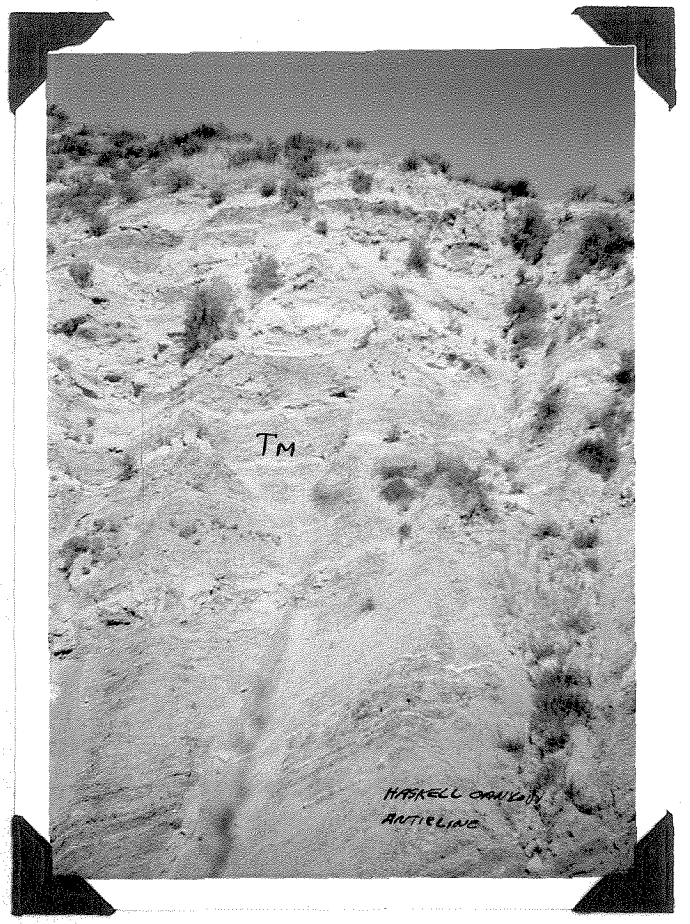


Fig.12
Modelo sandstones
and shales.

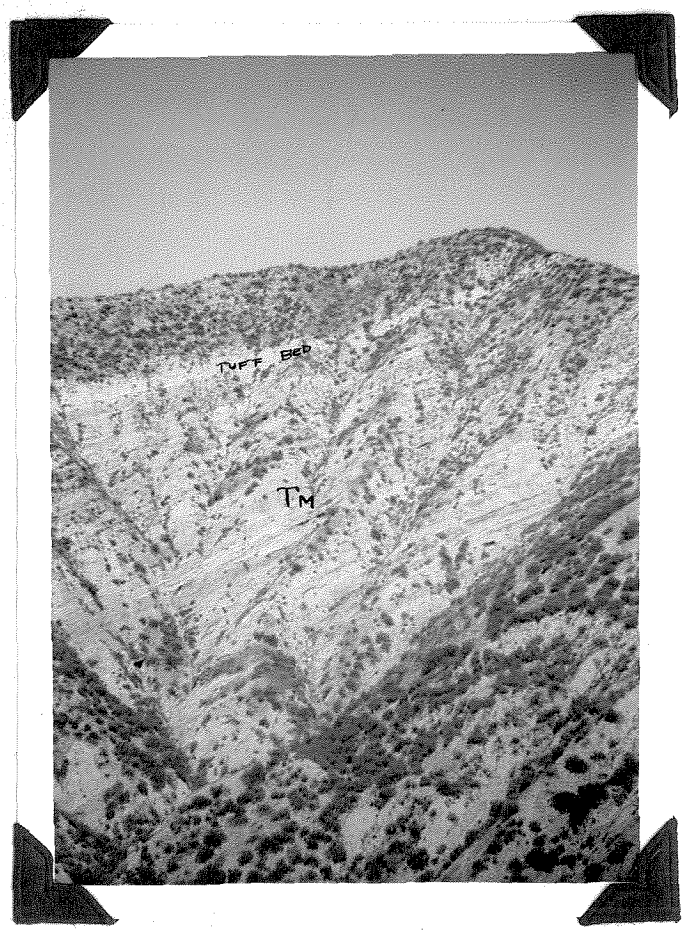


Fig.13
Modelo sandstones,
shales,and tuff bed.

Modelo section. Also in this later period, active vulcanism again took place in the Mojave Desert region causing great volumes of volcanic ashes to be deposited on the shallow sea producing a 15 foot thick tuff bed in the section. These conditions continued until the sea receded to the west.

The Modelo formation comprises the only marine strata north of the Santa Clara River in this general part of the Ventura Basin.

The upper Mint Canyon contact shows a distinct unconformity with the Modelo in Haskell Canyon. (see Fig.14) There is a difference of almost 90 degrees between the strikes of the strata of the Mint Canyon formation and the overlying strata of the Modelo formation. The Mint Canyon is much steeper in attitude than the Modelo. In San Francisquito Canyon the two formations seem to interfinger each other. There is no distinct unconformity in this part of the Dry Canyon area.

The Modelo formation is considered here to be upper Miocene in age.

Saugus formation

The Saugus formation lies unconformably on the Modelo sandstones and shales in this area. (see Fig.15) This formation was deposited on a broad flood plain or alluvial fan. This type of deposit is common in the present

Fig. 14

Contact between the Mint Canyon and the Modelo formations.

Fig. 15

Contact between the Saugus and the Modelo formations.

semi-arid climatic conditions of Southern California. There are good examples of alluvial fans in the Owens Valley region,which are being formed at the present time under conditions somewhat similar to the depositional conditions of the Saugus formation.

The Saugus beds are predominately light gray to white;some are reddish and others are even greenish in color. The strata are very poorly sorted and consolidated, ranging from boulder conglomerates to siltstones and clay beds. Fragments of the Pelona schist,granitics,and pure milky quartz rocks are very common in the Saugus formation. The Saugus has a more consolidated section in the upper part of the formation which is exposed on the cliffs which border the edge of the Santa Clara Valley between Dry Canyon and San Francisquito Canyon. The Saugus tends to form badlands topography which is very characteristic of the formation.

The formation is considered to be late Pliocene in age and extends over into the Pleistocene.

Quaternary terrace deposits

Terrace deposits are very common within the area. These terraces lie on top of all the older formations including the Pelona schist,the Mint Canyon,the Modelo, and the Saugus formations. These terrace deposits are nearly flat lying and consist of fragments of schist,granites,

and sandstones. (see Fig.16) Their color is characteristically red. Some exposures in upper Dry Canyon are almost 100 feet thick. These deposits were deposited under broad flood plain conditions somewhat the same as the conditions under which the Saugus was deposited. They cover the fault between the Mint Canyon and the basement complex;hence the faulting is at least pre-terrace in age.

Even more recent deposits than the terraces are the sands and gravels along the present stream courses. They are very coarse and unconsolidated. The largest and most widespread deposit of this type occurs in the stream bottom of San Francisquito Canyon. These alluvial deposits are being laid down at the present time.

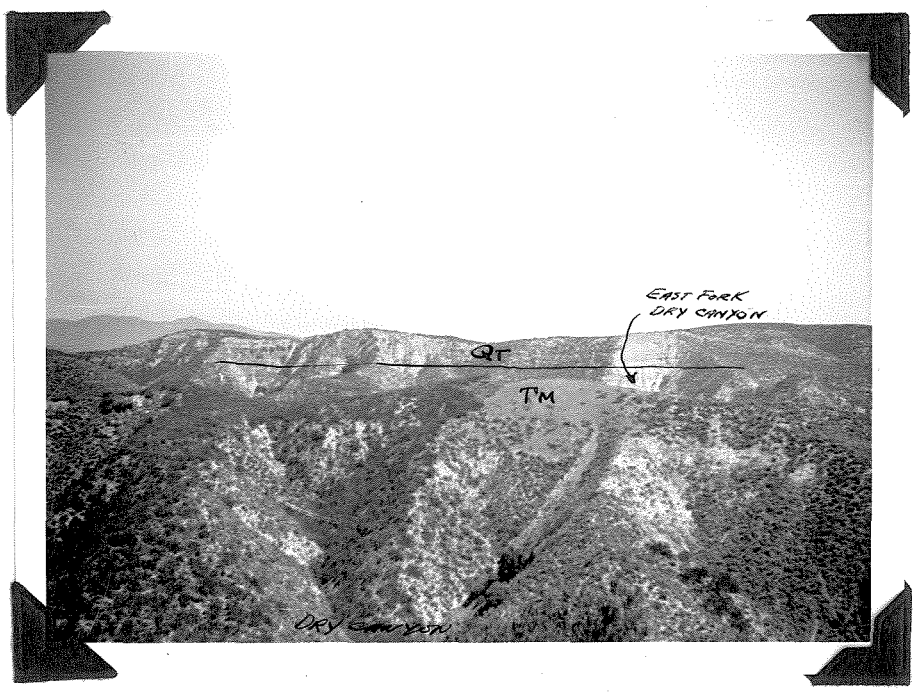


Fig.16
Terrace deposits.

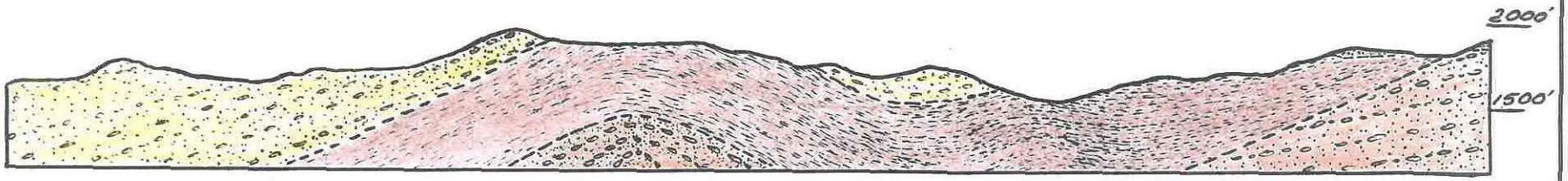
4. Geologic structure

Folding

The major structure in the area is a large anticline, which is exposed in Haskell Canyon. (see sections A-A' and B-B' in Fig.17 and C-C' in Fig.18) The anticline produces a large dome in the surface topography. (see Fig.19) The stratigraphic sequence is exposed in this anticline, the upper part of the Mint Canyon, the Modelo, and the Saugus. The unconformity between the Mint Canyon and the Modelo is very distinct in this anticline, as can be seen in the photograph. (see Fig.19) The unconformity between the Modelo and the Saugus is exposed, but it is not very distinct. In the anticline the Mint Canyon is folded at a much steeper angle than the overlying formations therefore there must have been some extensive Pre-Modelo folding in the region. The anticline plunges to the west and is traceable to San Francisquito Canyon. This is shown by the comparison of sections A-A' and C-C'. To the eastward the anticline plunges directly downward since there is no evidence of the fold to the east of the Haskell Canyon exposure.

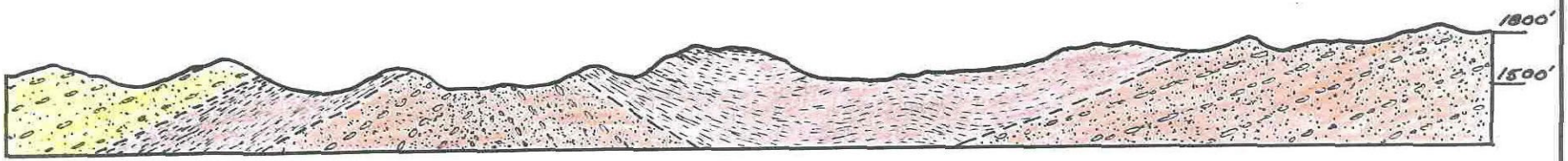
There are other minor folds elsewhere in the area. A gentle syncline occurs in the Saugus formation to the south of the major anticline and is traced from Haskell Canyon to San Francisquito Canyon. The Saugus is also folded into a minor anticline along the edge of

CROSS SECTIONS



A — A'

HASKELL CANYON ANTICLINE



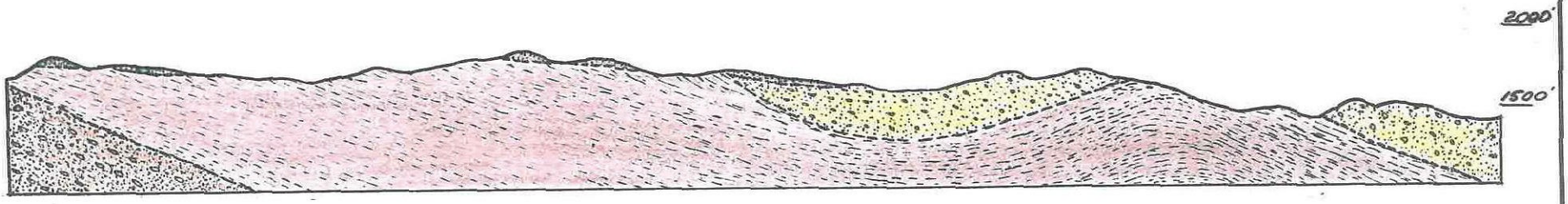
TERRACE
SAUGUS
MODELO
MINT CANYON

B — B'

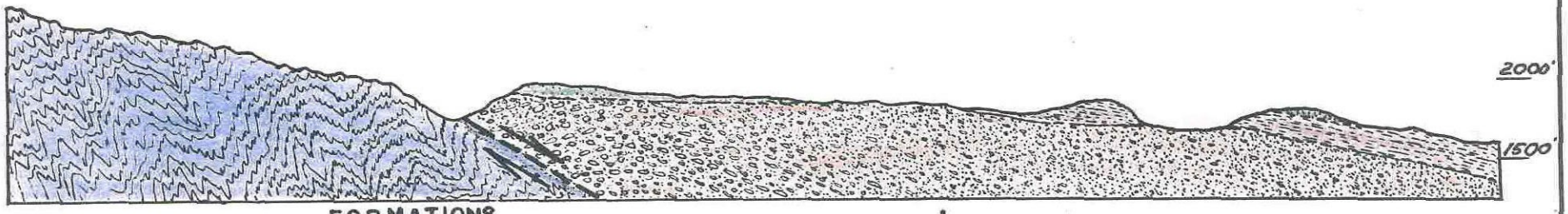
SCALE IN FEET
0' 2000'

FIG. 17

CROSS SECTIONS



C — C'



D — D'

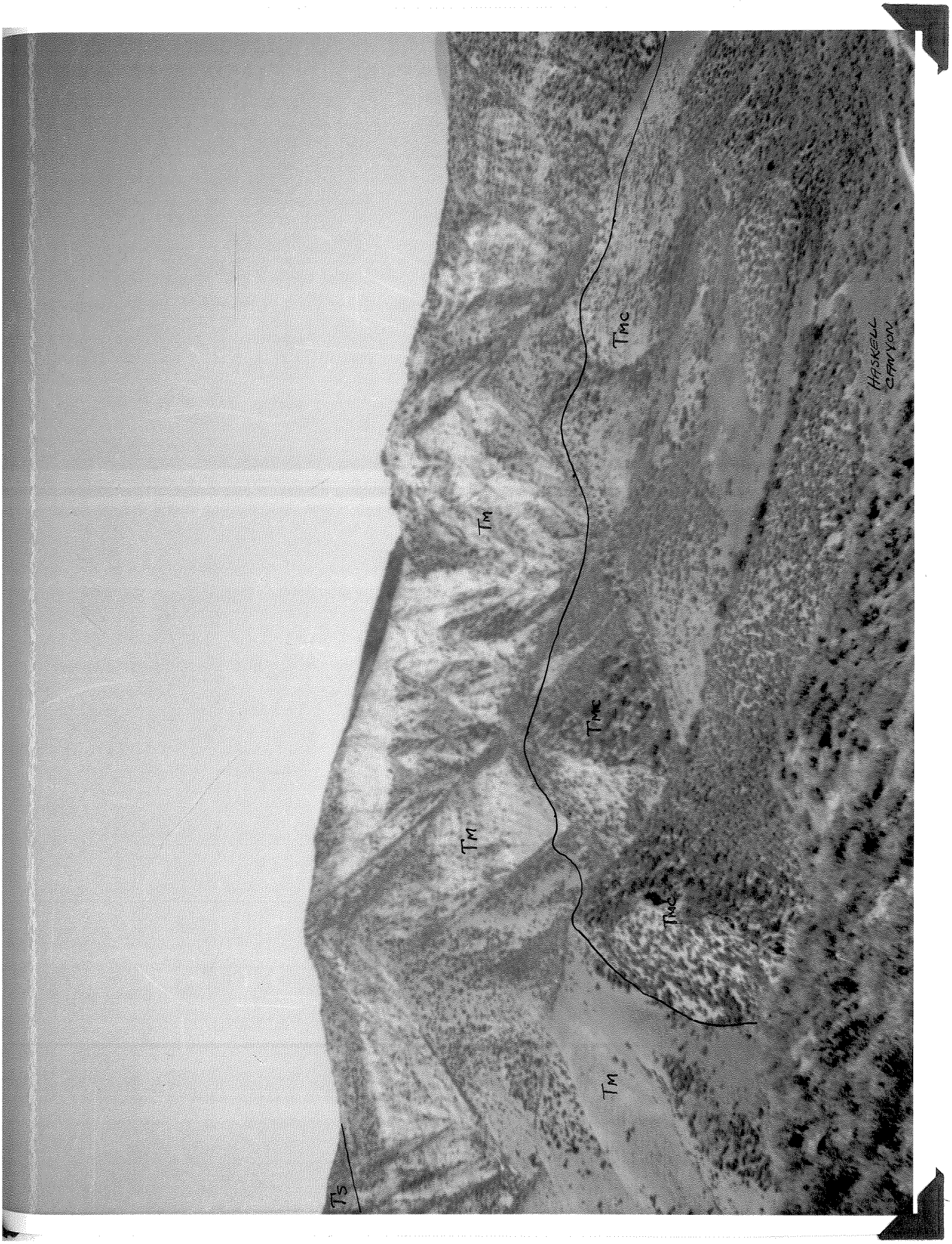
FORMATIONS

- TERRACE
- SAUGUS
- MODELO
- MINT CANYON
- BASEMENT COMPLEX

SCALE IN FEET
0' 2000'

FIG. 18

Fig.19
Haskell Canyon anticline.



the Santa Clara Valley. To the north of the Haskell Canyon anticline there is a small syncline which occurs in the Modelo and the Saugus formations and extends through to San Francisquito Canyon. Other minor folds occur within the Modelo formation but they are not very extensive. There is a minor anticline in the Mint Canyon formation just south of the fault along the edge of the Sierra Pelona Range.(see section D-D' Fig.18)

All the axes of the folds trend east-west, thus the forces of folding must have been constant in one direction.

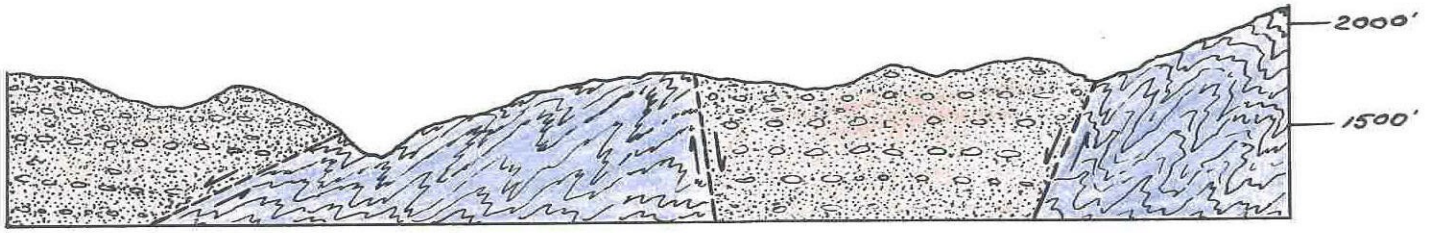
Faulting

The principal fault in the area is the normal fault along the base of the Sierra Pelona Ridge.(see section D-D' Fig.18 and section E-E' Fig.20) The north side has moved up. The dip of the fault ranges from about 20 degrees to almost vertical. This is evident in some exposures at the head of Dry Canyon. The major fault is not a single fault but is a series of anastomosing fault planes. There are several reentrants along the trace of the fault in a northeast-southwest direction.

The fault zone is very extensive toward the head of the central fork of Haskell Canyon, where the zone of shattered rock is several hundred feet wide. The fault zone in San Francisquito Canyon is also very wide. (see Figs. 21&22) Here is a gouge zone about thirty-five feet thick which consists of red, white, and blue clays.

CROSS SECTION

FAULTING,
EDGE OF THE
SIERRA PELONA MTS.



E —— E'

MINT CANYON
BASEMENT COMPLEX

SCALE IN FEET
0' 2000'

FIG. 20

Fig.21 Fault zone, San Francisquito Canyon

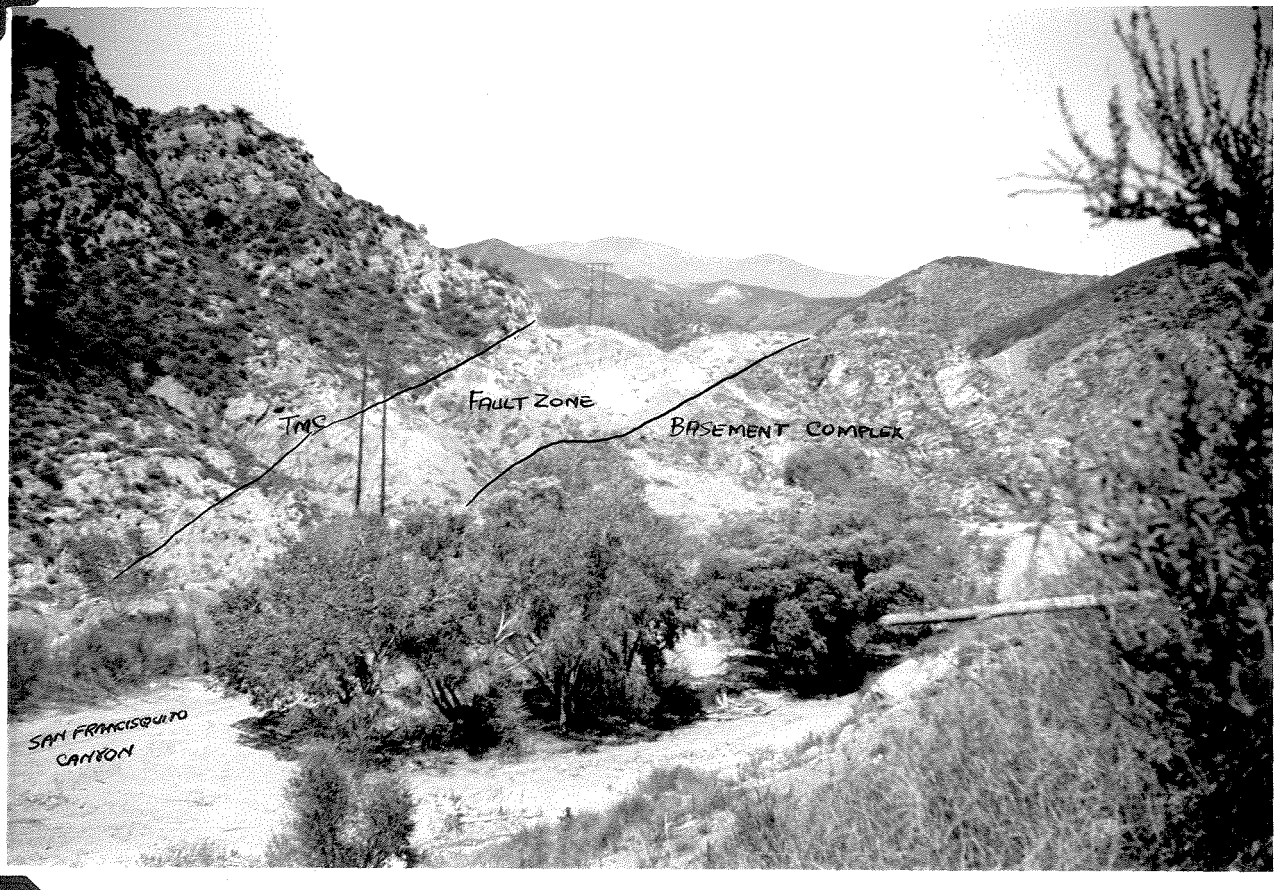


Fig. 22 Fault zone, San Francisquito Canyon.

Slickensides are evident in this zone near the basement complex contact.

The age of the fault is unknown,but it is Post-Modelo and probably Pre-Saugus. The faulting resulted in great regional uplift,which occurred before the Saugus formation was deposited. The displacement of the fault is also unknown,but it must have been several hundred feet in order to uplift more than two thousand feet of the Mint Canyon formation.

The question arises as to why there is not a thicker section of the Mint Canyon exposed in this area. There are two possible answers:(1) there was never deposited a thick section of the Mint Canyon or any of the older sedimentary formations.(2) the lower Mint Canyon section was faulted up and has been eroded away since the time of the faulting.

A thick section of the Mint Canyon may[3] have never[2] been deposited in this section of the Ventura Basin. The basin in this area may have been very limited and only a thin section was deposited. The reason why there is not an older series such as the Vasquez may have resulted from a closed basin,the mountain high was to the southeast and the sedimentary deposition thinned out to the northwest during this period prior to the deposition of the Mint Canyon series. During Mint Canyon time the mountain high was again to the north and the Mint Canyon was deposited

on top of a very thin section of the older sediments. These older sediments have never been exposed by erosion.

The second and the most logical answer is that the faulting has produced the thin section of the Mint Canyon in this area. The older sedimentary section as the Vasquez was overlain by a thick normal section of Mint Canyon formation. Major faulting occurred along the Sierra Pelona rift zone, elevating the basement complex and the overlying sediments. During the post-faulting period erosion has taken place, gradually wearing away this uplifted sedimentary section until all that remains today is the basement complex which forms the Sierra Pelona Ridge.

A possible minor fault occurs in the upper east fork of Dry Canyon where the Modelo has been faulted up to the surface adjacent to an 80 foot terrace exposure. This may not be a fault at all but may be a depositional feature. A canyon which developed in the Modelo formation may have been filled up by the terrace material, thus giving the appearence of a fault.

5. Geomorphology

The land forms in the Dry Canyon area are of several different types. The first type is a direct reflection of the folding in the sedimentary formations. The Haskell Canyon anticline is expressed on the surface as a large dome which is the most outstanding landform in the area. It has an elevation of 2031 feet above sea level and stands 300 feet above the average elevation of the surrounding ridges. To the north of this dome is a small synclinal gap. The Saugus formation has eroded away rapidly and has left the synclinal gap.

Another type of land form is the fault valley. The upper west fork of Haskell Canyon follows the fault line for a distance of about a half a mile in a southeast direction. Then the fault contact leaves the canyon and ascends the north side of the canyon. The stream has followed the weak rift zone and eroded away the brecciated rock.

The present canyons are very youthful with steep canyon walls. Erosion is proceeding at a rapid rate. The lower reaches of the valleys have reached a more mature stage and the streams have begun to meander back and forth on the flood plain basinward.

Remnants of old terraces are distinct in certain sections of the area. These terraces truncate all of the older formations and they are almost horizontal in attitude.

Since their deposition on a broad flood plain,uplift has taken place,and they are now several hundred feet above the present levels of the canyon bottoms. The present streams have dissected these old terraces to a high degree. These terraces are much more widespread in the area to the southeast of Bouquet Canyon called Puckett Mesa.

There is no fault scarp along the base of the Sierra Pelona Ridge because the faulting occurred early enough in geological time so that the scarp has been eroded away. The faulting occurred in Pre-Pliocene time.

Badlands topography is common in the Saugus formation because the material is very soft and unconsolidated. This topography is very distinctive of this formation.

6. Geologic history

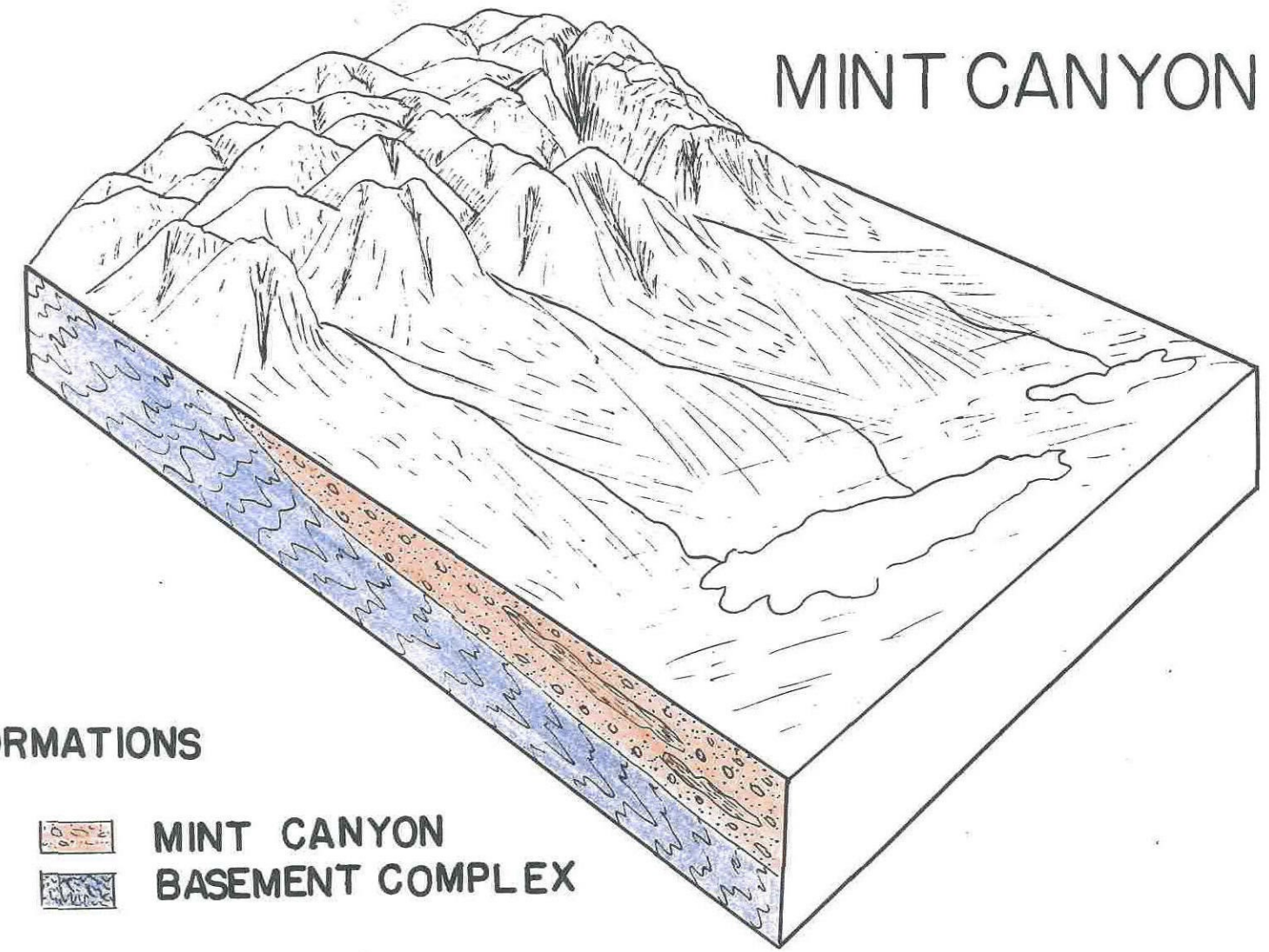
The oldest rocks in the area are the crystalline rocks of the basement complex. In some Pre-Cretaceous time older sedimentary formations were highly metamorphosed by intrusives to form the basement complex. After this period of metamorphism, widespread uplift occurred, creating a crystalline high which surrounded the basin. This high has remained in one form or another ever since.

Subsequent to the appearance of this high, rapid erosion took place, and sandstones and conglomerates were deposited in the basin. Later on the Mint Canyon was deposited on a broad flood plain that was dotted with several lakes. (see Fig. 23) Rainfall was sufficient to maintain these lakes for considerable periods as lacustrine deposits are common in the formation. During this period of deposition there was active vulcanism in the Mojave Desert region to the north. The volcanic ashes were deposited in the basin as tuff beds.

Minor tilting occurred toward the close of this period of continental deposition. In late Miocene time marine waters invaded the basin from the west as the region was depressed. Relief of the region was lowered. Brackish and marshy water conditions prevailed along the seacoasts. (see Fig. 24) Active vulcanism again took place in the Mojave Desert region and the volcanic ashes were deposited upon the shallow sea. A thick series of shales and sandstones were deposited during the time of the marine invasion.

BLOCK DIAGRAM

MINT CANYON TIME



FORMATIONS

- MINT CANYON
- BASEMENT COMPLEX

FIG. 23

BLOCK DIAGRAM MODELO TIME

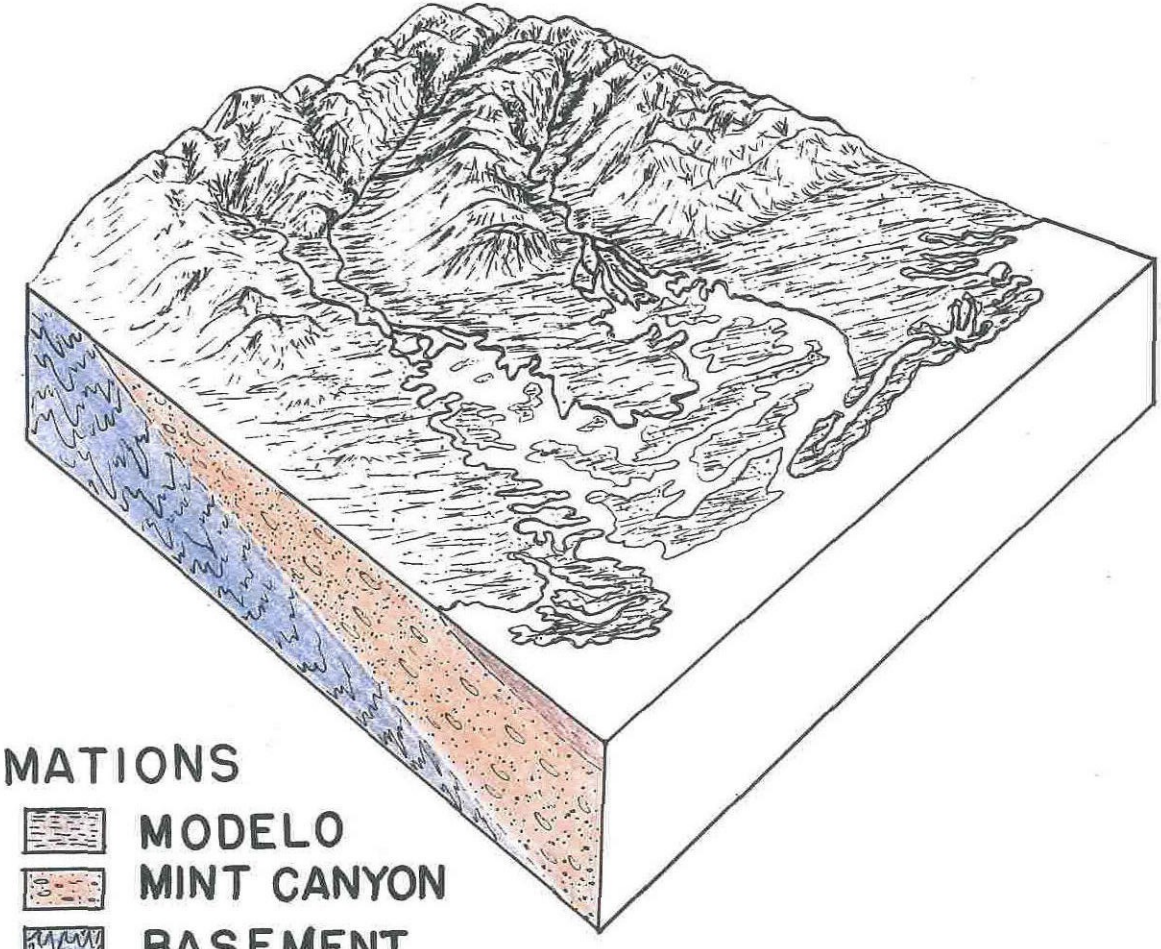


FIG. 24

As the marine waters withdrew to the west there was active faulting in the region. At this time the basement complex and the overlying sediments were faulted up and the long erosion cycle began.

In Pliocene and Pleistocene time broad flood plains developed. Along the mountain front there were extensive and broad alluvial fans. (see Fig.25) During this period of rapid erosion the Saugus continental beds were deposited.

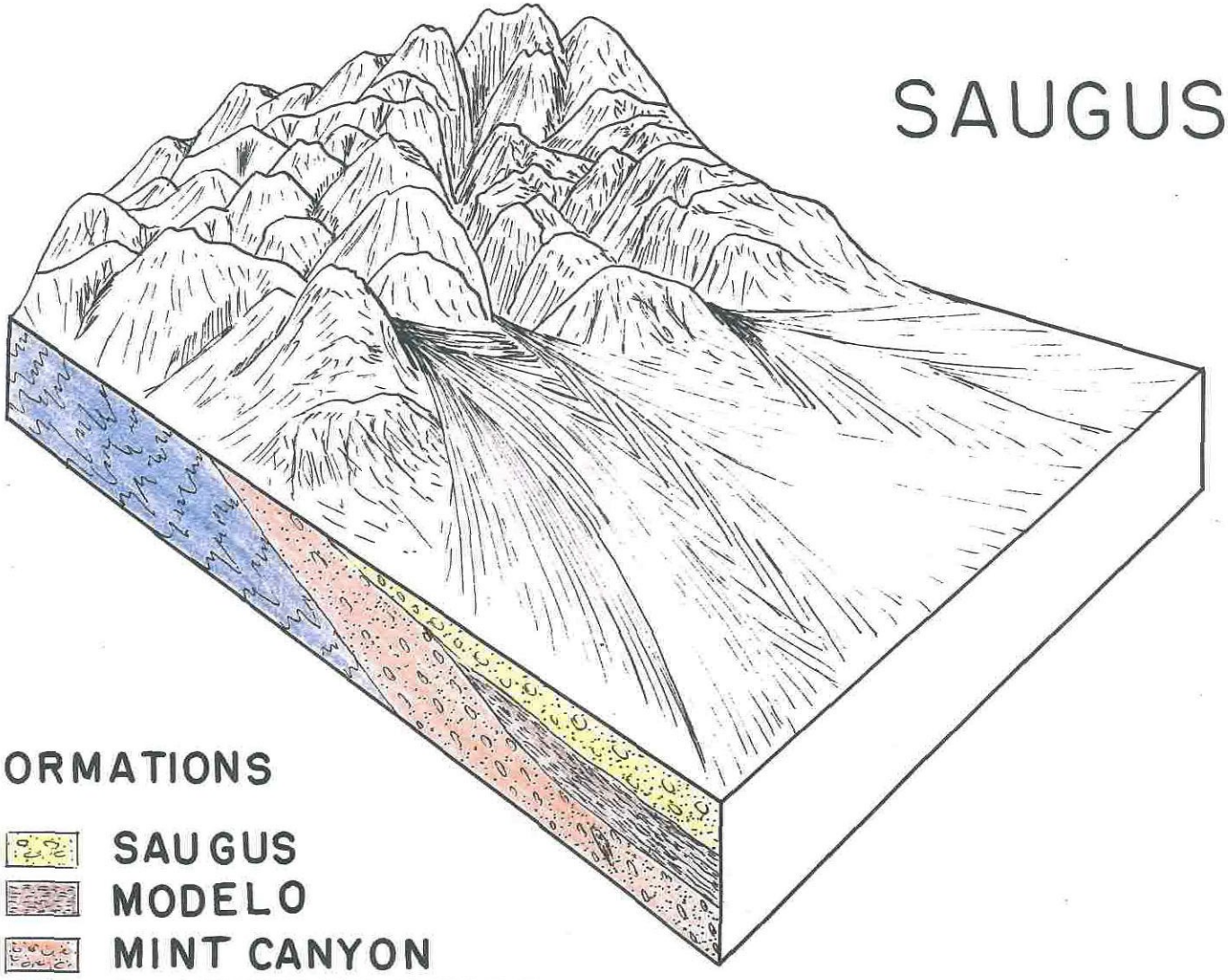
In late Pleistocene time additional folding and warping produced the major Haskell Canyon anticline of the present time. As the time progressed there were terrace deposits laid down over the Saugus and older sediments.

A general uplift of the region took place in late Pleistocene time,and erosion has dissected the terraces. As erosion continued the present drainage pattern developed. Since late Pleistocene time erosion has continued and alluvium has been deposited along the present stream courses. Some minor uplifts have occurred in the area in recent times.

Due to the present semi-arid climate in which the rainfall averages 15-20 inches a year,erosion is very spasmodic,being very rapid during periods of heavy rainfall. The basin itself has undergone little change since late Pliocene time.

BLOCK DIAGRAM

SAUGUS TIME



FORMATIONS

- SAUGUS
- MODELO
- MINT CANYON
- BASEMENT COMPLEX

FIG. 25

7. Economic aspects of the region

There is a possibility that some oil is located within the area. With a section of organic marine shales and sandstones as a source rock and the Mint Canyon formation below as a potential reservoir rock, some oil may be trapped in one of the structures of the area, especially in the Haskell Canyon anticline. No drilling has taken place within the area to the knowledge of the author. Due to the thinness of the marine section as a source, the oil may not be in large enough quantities for commercial exploitation.

Gold has been found in the Saugus formation. Some prospecting was done in two small tunnels in Haskell Canyon. The first gold in California was discovered in Placerita Canyon a few miles southeast of the area. It occurs in placer deposits.

This area was the scene of one of the most disasterous dam failures in American engineering history, when the St. Francis Dam failed in 1928 killing several hundred people. The dam was built by the Bureau of Water and Power of the City of Los Angeles to assist in the storage of water for the city. The dam was a gravity dam, 205 feet high and 700 feet long. It was located partially on the Pelona schist and about one-third of its length at the southwest end on the Mint Canyon formation. Between the two formations lies the principal fault in the area.

The dam failed due to the weakness of the Mint Canyon conglomerate when it was saturated with water. After the failure, the rock was subjected to several tests. It had a crushing strength of 500 lbs. p.s.i., but when it was immersed in water it crumbled and flaked to pieces. The dam was constructed without any geological examination of the damsite, and no crushing or immersion tests were made on the different rock types within the area. Thus some geological work would have prevented one of the worst disasters in American engineering history.

8. Bibliography

Jahns,R.H.,Stratigraphy of the eastermost Ventura Basin, California,with a description of a new lower Miocene mammalian fauna from the Tick Canyon formation:Carnegie Inst. Washington Pub. No. 514,pp. 145-194,1940

Kew,W.S.W.,Geology and oil resources of a part of Los Angeles and Ventura Counties,California:U.S. Geol. Survey Bull. 753,1924.

Woodring,W.P.,Age of the Modelo formation of the Santa Monica Mts.:(abstract) 28th annual meeting Cordilleran Section,Geol. Soc. America,Stanford University,1929.

Maxson,J.H.,Miocene-Pliocene boundary: 10th annual meeting, Pacific Section,Am. Assoc. Petroleum Geologists,Los Angeles,Nov.1938.

Hudson,F.J. and Craig,E.K.,Geologic age of the Modelo formation,California: Bull. Am. Assoc. Petroleum Geologists, vol.13,pp.509-518,1929.

Clements,T.,Structure of the southeastern part of Tejon quadrangle,California: Bull. Am. Assoc. Petroleum Geologists, vol.21,p.215,1939. 1937

Kleinpell,R.M.,Miocene stratigraphy of California:Bull. Am. Assoc. Petroleum Geologists,p.71,1938.

Maxson,J.H.,Geologic age of the earliest North American hipparion faunas: Geol. Soc. America,vol.49,no. 12,part 2,pp. 1916-1917,1938.

Stirton,R.A.,Mint Canyon mammalian fauna: Am. Jour. Sci. 5th ser.,vol.26,pp.569-570,1933.